Economics of Transportation/Land Use

New Urbanism
Clustered, Mixed-Use, Multi-Modal Neighborhood Design

People who live and work in attractive, accessible, walkable, multi-modal, and livable neighborhoods tend to drive less and rely more on alternative modes than in more automobile-dependent locations.

New Urbanism does not usually exclude automobile travel, but it increases transportation options, and sometimes gives priority to walking, cycling and transit. New Urbanism supports development of a more connected street network, often using a modified grid pattern. This provides multiple routes and more direct travel between destinations compared with a disconnected street network with many dead-end roads that result in more circuitous routes, and funnel traffic onto a few roadways.

Increased street connectivity has been shown to reduce per capita vehicle travel, and reduce traffic volumes on major roads. It also reduces risks for emergency access if a particular route is blocked.

Some New Urbanist designers suggest that streetscapes provide a sense of enclosure. As a general rule they recommend that urban street be no more than six times as wide across as the height of the buildings that line it, from the building front or row of trees on one side of the street, to those on the other. Urban buildings should be designed with details and amenities that are oriented to pedestrians, not just motorists.

How much difference do these factors make? If you live in a highly automobile dependent neighborhood, virtually every trip you make requires driving. If you live in a New Urban neighborhood you can conveniently go shopping and perform other personal by walking or cycling, and your children can walk to school and parks.

Common destinations such as stores, schools, recreation centers and commercial centers are closer together, so your car trips are shorter. The result is an increase in transportation options, and a reduction in total mileage and vehicle costs.

New Urbanism can give people better options for where they live and work. For example, many people want to “age in place,” that is, they want to continuing living in their community as they become older, rather than moving to a specialized retirement community. For this to be possible their community must have land use patterns with shops and other public services nearby, and diverse transportation services for people with various needs and abilities, including good walking facilities that accommodate mobility aids and wheelchairs, and various types of transit services.

New Urbanist features tend to increase the value and marketability of buildings. National market surveys indicate that about a third of home buyers would prefer to live in New Urbanist community if available (Hirschhorn and Souza, 2001; Bohl, 2003).

A study by Eppli and Tu (2000) found that homes in New Urbanist communities sold for an average of $20,189 more than otherwise comparable homes in more conventional communities, an 11% increase in value.

Song and Knaap (2003) also found that New Urban features increase property values. Studies summarized by Smith and Gihring (2003) indicate that proximity to public transit services can significantly increase property values.

New Urbanist development may face various barriers. Many current planning regulations and development practices in North America conflict with New Urbanist principles (Smart Growth Policy Reforms).

For example, zoning codes often require more parking and wider streets than considered appropriate by New Urbanists. Zoning codes also discourage commercial activities and secondary living units in residential areas, and require large setbacks for homes and businesses that reduce densities and land use mix.

Another barrier to New Urbanism is that the real estate industry is highly segmented by land use category (such as single-family housing, multi-family housing, retail, office and warehouse). Each category has its own practices, markets, trade associations, and financing sources. New Urbanists requires a more integrated approach to development that requires changing these practices and coordinating stakeholders (Leinberger, 2001).

Implementation

New Urbanist features can be designed into new development or implemented incrementally in existing neighborhoods. It usually requires changes to street design standards, and to zoning laws to allow higher densities and mixed land use. Urban renovation projects can incorporate New Urbanism features, including commercial infill and walkability.

A new approach to building codes, called "form-based codes" is an important tool for implementing New Urbanist development. Form-based codes provide guidelines and building requirements that define a particular type of development desired in a particular area, such as low- or medium-density residential, or mixed-use urban village. It provides greater design flexibility and coordination than conventional, land use based codes.

Travel Impacts

New Urbanism improves accessibility, improves transportation choice, and reduces traffic speeds, which tend to reduce per capita automobile ownership and use. Although most individual design features have modest impacts on total travel, their effects are cumulative and synergistic, resulting in significant total reductions in vehicle use (NEW, 2001).

Residents in well-designed New Urbanist neighborhoods with good walkability, mixed land use, connected streets, and local services tend to drive 20-35% less than residents in automobile dependent areas, and even greater vehicle travel reductions may be possible if New Urbanism is coordinated with other TDM strategies, such as transit improvements, car sharing, road pricing, parking management and commute trip reduction programs.

Khattak and Rodriguez (2005) found that, controlling for demographic factors, residents of a neo-traditional community (Southern Village in Chapel Hill, NC) generate 22.1% fewer automobile trips and take 305.5% more walking trips than residents of conventional design communities. These include reductions in both commute and non-commute automobile travel. In the neo-traditional community, 17.2% of trips are by walking compared with 7.3% in the conventional community. Average per capita time spent in travel is similar between the two groups.

Benefits

New Urbanism can provide a variety of economic, social and environmental benefits.

- More housing and commercial options for consumers.
- Increased property values.
- Improved transport and access for non-drivers, and support Universal Design.
- More affordable housing (Location Efficient Development).
- It can reduce automobile dependency and use, providing consumer cost savings and reductions in automobile travel that provide social benefits (such as reduced traffic congestion, parking costs, accident risk, pollution and urban sprawl).
- It can significantly improve community livability, interaction and cohesion.
- Increased traffic safety due to narrower streets and slower traffic (Traffic Calming).
- Improved public health due to increased walking and cycling.
- Greenspace and wildlife habitat preservation.
- Reduced air pollution.
- Reduce resource consumption.
- Reduced water pollution.
- Reduced "heat island" effect.
- More attractive communities.
- Improved transportation choice, particularly for non-drivers.
- Improved housing choices.

Households living in communities with more diverse transportation systems save hundreds or thousands of dollars annually on transportation costs.

Costs

Costs include the additional expenses associated with more detailed planning, design and amenities (sidewalks, transit, public spaces), and extra development costs associated with construction within existing urban areas.

Some critics argue that New Urbanism and Smart Growth reduce housing affordability, but while some features do increase housing costs (such as urban growth boundaries), others reduce these costs (such as reduced parking and setback requirements, and secondary suites), allowing housing to be more affordable overall (Litman, 2000; Arigoni, 2001).

Higher-density, infill development may increase local traffic congestion and exposure to noise and air pollution, although regional traffic and pollution tends to decline if residents drive less. Increased density often reduces the amount of green space within an urbanized area, although it can increase total regional green space by reducing per capita area of land development.

Equity Impacts

New Urbanism design features have a variety of equity impacts. Some impacts may affect certain groups more than others, such as the effects of infill on existing neighborhoods. It can reduce subsidies associated with lower-density, sprawl development and automobile dependency. It can increase consumer housing and transportation choices, providing benefits to lower-income households and non-drivers. As described above, some New Urban developments are relatively expensive, but many New Urban design features (such as small lots, clustered development, and reduced parking and road requirements) can reduce housing costs. Increased access and travel choice, and transportation cost savings tend to significantly benefit lower-income households and non-drivers. New Urban designs can reduce some externalities associated with lower-density, automobile-oriented development.

Applications

New Urbanism design features are appropriate in any urban or suburban area, particularly those experiencing high levels of growth and problems associated with housing in affordability and sprawl. They are implemented primarily by regional and local governments, and developers.

Stakeholders

New Urbanism is generally implemented by local governments and developers. Neighborhood associations, business associations and developers are also important stakeholders with regard to many specific New Urbanist policies and projects.

Barriers to Implementation

Existing zoning laws and development policies often discourage or prohibit New Urbanism designs. There is sometimes local resistance to higher density, infill development.

Best Practices

- Educate planners and developers about New Urbanist strategies.
- Implement comprehensive New Urbanist policies, rather than just one or two strategies.
- Encourage cooperation between public and private decision makers to facilitate New Urbanism.
- Promote distinctive, attractive communities with a strong sense of place, including the rehabilitation and use of historic buildings.
- Strengthen and encourage growth in existing communities.
- Mix land uses.
- Create a range of housing opportunities and choices.
- Provide a variety of transportation choices.
- Foster "walkable" close-knit neighborhoods.
- Strengthen and encourage growth in existing communities.
- Locate development in areas with existing infrastructure.
- Include mixed land uses. Mixed-use projects should include residential housing, significant employment opportunities from office or light industrial facilities, retail shopping, outdoor recreation and open spaces. Larger projects should also include schools and entertainment facilities.

- Create a range of housing opportunities. Residential development should be mixed-income and offer a range of single- and multi-family units, with special attention to affordable housing.

- Preserve Open Space, farmland, natural beauty and critical environmental areas. Projects should consume a minimum of greenspace and avoid fragmenting habitat. Compact design should minimize the amount of land used per capita.

- Provide a variety of transportation choice. Locate projects along transit lines. Communities should support walking and cycling transportation. Connected street patterns should provide multiple routes, maximizing accessibility. Telecommuting should be encouraged.

- Foster walkable, close-knit neighborhoods. pedestrian-friendly design employs clustered and mixed land uses, and good walking facilities. Neighborhood design and layout should promote interactions among residents.

- Take advantage of existing community assets. New projects should take advantage of existing transit facilities, greenspace, schools, retail areas and cultural amenities. Brownfield sites should be seen as opportunities for land recycling.

- Promote distinctive, attractive communities with a strong sense of place, including the rehabilitation and use of historic buildings. Whenever historic and older buildings are present, their rehabilitation and reuse should be part of the new design. Architectural criteria and community layout should maximize a sense of local community in harmony with the natural setting.

- Encourage citizen and stakeholder participation in development decisions. Provide opportunities for all stakeholders to participate in decision makers.

- Make development decisions predictable, fair and cost effective. Local governments with zoning code responsibilities should facilitate innovative community designs consistent with Smart Growth principles, and they should not impose obstacles and delays that may place such designs at a competitive disadvantage to more common “sprawl” projects.

Smarter Growth

Over the past 50 years, as development has become increasingly spread out, people have become accustomed to driving to complete even short-distance errands. Even in development projects with exercise trails, developers have traditionally considered trail systems solely as a recreational amenity, rather than having a transportation purpose. As a result, such trails are seldom connected to outside destinations.

Moreover, while there are health benefits achieved by walking purely for exercise, a large percentage of people do not make time for regular fitness activities. More people would be apt to reap the benefits of exercise if they were provided more opportunities to integrate walking or biking into daily tasks.

The high number of individuals driving from one dispersed location to another is reflected in transportation data showing a national average of 230 million solo-driver trips daily. In comparison, there are 98 million multiple-passenger car trips daily; 20 million trips involving walking; seven million public transit trips; and three million bicycle trips.

Despite being a distant second to the automobile, walking is “the most common alternative to driving,” To promote walking, you need an attractive destination, attractive paths for connection, and a layout that promotes compact, multi-use development.

Continuing to build in a conventional manner, emphasizing low-density, isolated uses and heavy auto dependence, would require $1 billion in transportation infrastructure improvements by 2050; the funds would be spent on bypasses and wider roads to serve dispersed areas on the fringe.

However, under an alternative plan, development would be clustered strategically around community focal points, with an emphasis on pedestrian-friendly design as well as an expansion of the transit system. This plan would reduce the need for roadway investment by $500 million – half the cost of the "business as usual". Walkable communities supported by efficient transportation networks are viable, sustainable, and less expensive (to develop) than building freeways to accommodate dispersed growth.

Because their impacts tend to be synergistic (total impacts are greater than the sum of their individual impacts) Smart Growth does not involve just one single change, it requires a number of integrated changes. For example, more compact development, improved walkability or increased transit service quality by themselves cannot be considered Smart Growth; rather, a Smart Growth program might involve more compact development, improved walkability *and* increased transit service quality.

Smart Growth emphasizes accessibility, meaning that the activities people use frequently are located close together. For this reason, the basic unit of planning is the local community, neighborhood or "village," that is, a mixed-use area, one-half to one mile in diameter, with commonly-used public services (shops, schools, parks, etc.) arranged into a central commercial area. This is in contrast to conventional planning, which tends to emphasize *mobility* as a solution to transport problems, and so tends to plan communities at a larger scale which relies primarily on motor vehicle travel, with little consideration to pedestrian access.

Smart Growth results in modest reductions in per capita motor vehicle travel, typically reducing private automobile trips from the current 90-95% to 60-80% of trips by shifting a portion of local trips to non-motorized modes, and regional trips to ridesharing and transit.

There is growing convergence of support for Smart Growth among a variety of professions and interest groups, ranging from transportation planners concerned with a variety of economic, social and environmental issues. For example transportation planners increasingly support Smart Growth as a way to improve accessibility (ITE, 2002), public officials support it as a way to reduce public infrastructure and service costs (Hirschhorn, 2001), some people support it as a way to reduce environmental impacts, and others as a way to create more livable communities.

Although clustering of activities (such as locating commonly-used retail and public services near residential areas, and grouping worksites and retail together into commercial centers) and increased density are important Smart Growth strategies, it does not require a particular level of density to be effective, it simply requires more clustering and density than would otherwise occur.

There is considerable debate concerning the desirability of Smart Growth. Critics argue that Smart Growth provides little real benefits, increases congestion, makes residents worse off, and is unpopular with consumers. Proponents counter that the total economic, social and environmental benefits are substantial, and point to the popularity of New Urbanism developments and to surveys indicating that consumers prefer communities with coordinated planning and Smart Growth design features (Eppli and Tu, 2000), and in some areas population and employment trends have favored urban over suburban areas (Hughes and Seneca, 2004).

Smart Growth critics tend to focus on individual factors without considering the overall effects of a coordinated Smart Growth program (Litman, 2003). For example, critics often highlight negative impacts associated with density, such as increased congestion, without considering how Smart Growth can offset such problems by improving access and travel choice.

Travel Impacts

Smart Growth does not eliminate automobile travel, but it can significantly reduce per capita automobile travel compared with sprawled development patterns, as discussed in the chapters on land use impacts and transportation price elasticities. Smart Growth tends to reduce automobile travel through specific mechanisms described below.

- Clustering of population and employment, which increases accessibility (e.g., proximity to employment, shops and schools), and travel choice (better transit, ridesharing, and better pedestrian facilities).
- Land use mix, such as commercial and public services located within or adjacent to residential areas, which increases access and travel choice.
- Parking management and parking pricing can reduce automobile travel, encourage use of alternative modes, and reduce the amount of land paved for parking facilities, creating accessible and pedestrian-friendly landscape.
- Traffic calming and other measures that reduce automobile traffic speeds, which reduces driving and improves conditions for walking, cycling and transit use.
- A more connected street network improves access.
- More attractive, safer streets, and pedestrian-oriented land use, encourages non-motorized travel.
- An effective transit system tends to reduce per capita automobile travel, particularly when integrated with supportive land use (high-density development with good pedestrian access within half-kilometer of transit stations).
- Other TDM strategies can be incorporated into Smart Growth, including commute trip reduction, and school and campus trip reduction to further reduce per capita vehicle travel.

Factor	Definition	Travel Impacts
Density	People or jobs per unit of land area (acre or hectare).	Increased density tends to reduce per capita vehicle travel. Each 10% increase in urban densities typically reduces per capita VMT by 1-3%.
Mix	Degree that related land uses (housing, commercial, institutional) are located close together.	Increased land use mix tends to reduce per capita vehicle travel, and increase use of alternative modes, particularly walking for errands. Neighborhoods with good land use mix typically have 5-15% lower vehicle-miles.
Regional Accessibility	Location of development relative to regional urban center.	Improved accessibility reduces per capita vehicle mileage. Residents of more central neighborhoods typically drive 10-30% fewer vehicle-miles than urban fringe residents.
Centeredness	Portion of commercial, employment, and other activities in major activity centers.	Centeredness increases use of alternative commute modes. Typically 30-60% of commuters to major commercial centers use alternative modes, compared with 5-15% of commuters at dispersed locations.
Network Connectivity	Degree that walkways and roads are connected to allow direct travel between destinations.	Improved roadway connectivity can reduce vehicle mileage, and improved walkway connectivity tends to increase walking and cycling.
Roadway design and management	Scale, design and management of streets.	More multi-modal streets increase use of alternative modes. Traffic calming reduces vehicle travel and increases walking and cycling.
Walking and Cycling conditions	Quantity, quality and security of sidewalks, crosswalks, paths, and bike lanes.	Improved walking and cycling conditions tends to increase nonmotorized travel and reduce automobile travel. Residents of more walkable communities typically walk 2-4 times as much and drive 5-15% less than if they lived in more automobile-dependent communities.
Transit quality and accessibility	Quality of transit service and degree to which destinations are transit accessible.	Improved service increases transit ridership and reduces automobile trips. Residents of transit oriented neighborhoods tend to own 10-30% fewer vehicles, drive 10-30% fewer miles, and use alternative modes 2-10 times more frequently than residents of automobile-oriented communities.
Parking supply and management	Number of parking spaces per building unit or acre, and how parking is managed.	Reduced parking supply, increased parking pricing and implementation of other parking management strategies can significantly reduce vehicle ownership and mileage. Cost-recovery pricing (charging users directly for parking facilities) typically reduces automobile trips by 10-30%.
Site design	The layout and design of buildings and parking facilities.	More multi-modal site design can reduce automobile trips, particularly if implemented with improved transit services.
Mobility Management	Policies and programs that encourage more efficient travel patterns.	Mobility management can significantly reduce vehicle travel for affected trips. Vehicle travel reductions of 10-30% are common.

This table describes various land use factors that can affect travel behavior and population health.

Although individual strategies may have modest travel effects, typically reducing total vehicle traffic by just a few percentage points, their impacts are cumulative and synergetic. A comprehensive Smart Growth program using cost-effective strategies (i.e., strategies that are fully justified for their direct economic and consumer benefits) can reduce total per capita automobile travel by 20-40% compared with conventional, automobile-dependent land use patterns and transportation policies.

Estimated 25 Year Public Costs for Three Development Options (Blais, 1995)

	Spread	Nodal	Central
Residents per Ha	66	98	152
Capital Costs (billion C$ 1995)	54.8	45.1	39.1
O&M Costs (billion C$ 1995)	14.3	11.8	10.1
Total Costs	69.1	56.9	49.2
Percent Savings over "Spread" option	n/a	17%	29%

This table shows substantial public savings for higher density land use patterns associated with Smart Growth development.

Smart Growth tends to reduce per capita energy consumption and pollution emissions, although it may increase pollutant concentrations and therefore exposure to pollutants with localized impacts, such as noise and carbon monoxide. Per capita energy savings can be substantial. According to one study, designing all new communities on Smart Growth principles could reduce total U.S. energy consumption by about 10% after a decade (Burer, Goldstein and Holtzclaw (2004).

Smart Growth is sometimes criticized because land use change is slow, and so impacts and benefits take many years to be achieved. In most communities only 1-4% of land is developed or redeveloped during a typical year, so it often takes decades before significant regional travel impacts are achieved. But these changes can provide many benefits and are extremely durable once implemented.

Many higher-density urban neighborhoods have higher rates of social problems (crime and poverty) than lower-density suburban neighborhoods. Although studies find an association between crowding (density measured in residents per residential room, an indication of poverty) and social problems, there is no such association with density measured in residents per acre (1000 Friends of Oregon, 1999). This suggests that the association between density and social problems reflects the tendency of distressed households to concentrate in higher-density, urban neighborhoods, not that higher-density development causes social problems. This indicates that increasing middle-class housing density does not increase social problems, and urban infill could reduce such problems if distressed households become less segregated.

Another objection to some Smart Growth measures, such as urban growth boundaries, is that they increase housing costs by reducing the supply of land available for residential development (Litman, 2001). However, other Smart Growth strategies increase housing affordability by allowing more diverse housing types (such as multi-family and secondary suites) and by reducing development costs (Jia and Wachs, 1998; Litman, 1998; Arigoni, 2001). Smart Growth can also reduce households' transportation costs, which can offset increased housing costs. More Smart Growth reduces rather than increases household costs. This suggests that Smart Growth can increase overall housing affordability, or at least cannot be blamed for reduced housing affordability (Nelson, 2000).

Equity Impacts

Smart Growth includes many specific components that have various equity impacts. Some impacts may affect certain groups more than others, such as the effects of infill on existing neighborhoods. Smart Growth includes some measures, such as variable development fees that reflect the costs of a particular location, which internalize economic and environmental costs associated with development. This reduces horizontal inequity by reducing cross-subsidies (for example, by reducing subsidies from residents for existing urban housing to residents of new suburban housing to finance the higher public service costs of such development).

Smart Growth increases accessibility and transportation options, which benefits lower income households and non-drivers. Sprawl increases minimum transportation costs. In an automobile-dependent community, households have no alternative to owning an automobile. For middle- and upper-class households this is not a major burden, many spend much more than they need for extra automobile comfort and prestige features. But for lower-income families the costs of automobile dependency can be high, reducing consumer choice and household wealth. The increased transportation affordability of Smart Growth can provide significant vertical equity benefits by improving transportation choice and opportunities to save money for lower-income households.

Smart Growth can have both positive and negative impacts on disadvantaged populations. It can increase urban housing costs and cause "gentrification" (displacement of existing low-income urban communities), but it can also improve the livability (community cohesion, safety, health and environmental quality) of disadvantaged urban community, increase economic opportunity and development among low-income populations, and help preserve the unique features of existing urban communities.

Specific Smart Growth criticisms are summarized below

Consumers Prefer Sprawl and Automobile Dependency

Critics claim that consumers prefer sprawl and automobile dependency. But there is considerable evidence that many consumers prefer Smarter Growth communities and alternative transport modes, particularly if supported with suitable policies. Critics ignore many direct benefits that Smart Growth can provide to consumers, including financial savings, increased physical exercise, community cohesion, improved transport options for non-drivers, and greenspace preservation.

Smart Growth Increases Regulation and Reduces Freedom

Critics claim that Smart Growth significantly increases regulation and reduces freedoms. But many Smart Growth strategies reduce existing regulations and increase various freedoms. Overall, Smart Growth tends to increase more freedoms than it reduces, for example, by allowing more flexible development designs and providing more consumer travel options.

Smart Growth Reduces Affordability

Critics claim that Smart Growth increases housing costs by reducing land supply, but ignore various ways it reduces household costs by reducing unit land requirements, increasing housing options, reducing parking and infrastructure costs, and reducing consumer transport costs. The evidence critics use to evaluate housing affordability fails to account for confounding factors, such as higher housing costs in larger cities, and the tendency of Smart Growth to be implemented in areas experiencing rapid population and economic growth, which tends to raise housing costs.

Smart Growth Increases Congestion
Critics claim that Smart Growth increases traffic congestion and therefore reduces transport system quality, based on simple models of the relationship between density and trip generation. However, Smart Growth does more than just increase density, it also increases accessibility and travel options, and provides incentives to reduce urban-peak vehicle trips, which tend to reduce congestion. Traffic congestion alone is an ineffective indication of transport system quality since increased congestion can be offset if travel distances decline and travel options improve, so less driving is needed to reach destinations. Empirical data indicate that Smart Growth does not increase per-capita congestion delay or average commute times.

Public Service Costs
Although many studies indicate Smart Growth can reduce development and public service costs, critics dismiss these studies, claiming that sprawl provides overall savings. But critics incorrectly measure Smart Growth only in terms of density, consider a limited set of total infrastructure and public costs, and ignore higher wages and public service quality in larger cities.

Transit Benefits
Critics claim that public transit investments are not cost effective because the costs of attracting additional riders are high and overall ridership is too small to reduce traffic congestion. This overlooks the fact that transit ridership tends to be greatest on major urban corridors where congestion is greatest, that transit improvements are often more cost effective than highway capacity expansion, that Smart Growth strategies can increase transit operating efficiency and ridership, and that public transit service provides many other benefits to society. When all costs and benefits are considered, Smart Growth programs that improve transit service and encourage transit ridership are often the most cost effective way to improve transportation systems.

Economic Development
Critics claim that Smart Growth is harmful to the economy. But Smart Growth can increase economic efficiency and productivity, and is associated with higher incomes and economic growth.
Some objections raised by critics are actually justifications for more Smart Growth. For example, critics argue that density increases traffic congestion, which justifies implementing additional Smart Growth strategies to improve accessibility and encourage use of non-automobile modes in urban and suburban areas experiencing growth. Critics raise some legitimate concerns, such as that Smart Growth can have unintended consequences and can increase some costs. But these can be addressed with good planning. They are not fatal flaws.

Land use patterns affect the costs of providing public infrastructure and services such as roads, water, sewage, garbage collection, school transport and mail delivery. Various studies show that these costs tend to increase with sprawl (dispersed development outside existing urban boundaries), and can be reduced with Smart Growth (compact, planned development within existing urban boundaries).

Smart Growth can save hundreds of dollars annually per capita compared with providing comparable public services to sprawled destinations. Most current development charges, utility fees and taxes fail to accurately reflect these location-related cost differences, representing a subsidy of sprawl.

Understanding Smart Growth Savings
The local newspaper charges higher subscription fees for delivery to suburban locations. Similarly, many urban stores and restaurants offer free or inexpensive delivery, but suburban stores either lack delivery service or charge a significant fee.

Most activities that involve distribution (products being delivered to a destination) or interaction (numerous people and materials being brought together) are more efficient with compact land use patterns, because less travel is required to reach destinations.

Although costs per mile tend to increase in denser areas, due to congestion and friction, unit costs tends to decline because each mile serves more destinations. These efficiencies are why people and businesses tend to cluster into cities, towns and business districts.

Types of Cost Savings
Distribution (One-to-Many) Interaction (Many-To-Many)

- Newspaper, mail, and courier delivery
- Water supply, sewage and storm water management
- Road and sidewalk networks
- Electricity, telephone and cable lines
- Garbage collection
- Government services, such as policing
- School busing
- Schools, colleges and universities
- Retail centers
- Businesses
- Recreational and cultural activities
- Emergency services

Evidence of Smart Growth Savings

One of the many Smart Growth benefits is its ability to reduce public infrastructure and service delivery costs. Capital costs increase for lower density, non-contiguous development. Higher density, clustered, infill development can provide hundreds of dollars in annual savings compared with sprawl.

Burchell and Mukherji (2003) found that sprawl increases local road lane-miles 10%, annual public service costs about 10%, and housing costs about 8%, adding about $13,000 per dwelling unit. Table 4 shows how school, road and utility costs per residential unit vary depending on development density. Rural Sprawl costs are about 60% more than denser urban development.

Annualized Municipal Costs for Different Densities (Smythe, 1986)

Costs	Higher Density	Medium Density	Rural Cluster	Rural Sprawl
Units/Acre	4.5	2.67	1	0.2
Schools	$3,204	$3,252	$4,478	$4,526
Roads	$36	$53	$77	$154
Utilities	$336	$364	$497	$992
Totals	$3,576	$3,669	$5,052	$5,672
Incremental Cost	NA	3%	41%	59%

Per household annual municipal service costs increase with sprawl, based on a prototypical community of 1,000 units housing 3,260 people, 1,200 students. Compared with Higher Density, Rural Cluster increases costs 41%, and Rural Sprawl 59%.

Table 5 summarizes public costs (utilities, government services and transportation infrastructure) for three possible development patterns in the Toronto region, showing significant potential savings for the more clustered option.

In addition to these costs, the “Nodal” and “Central” options provide additional savings by reducing per capita annual vehicle mileage, and therefore costs such as traffic congestion and pollution.

Table 5 Public Costs of Three Development Options (Blais, 1995)

	Central	**Nodal**	**Spread**
Residents per Ha	152	98	66
Capital Costs (billion C$1995)	39.1	45.1	54.8
O&M Costs (billion C$1995)	10.1	11.8	14.3
Total Costs	49.2	56.9	69.1
Percent Savings over “Spread” option	40%	16%	NA

This table compares the estimated 25-year public costs of three land use development options, in millions of dollars. More spread development substantially increases costs.

Table 6 compares the public infrastructure costs of a low-density “Sprawl” and high density “Smart Growth” scenarios in the Twin City region. Costs per household are more than double under the sprawl development patterns. The sprawl development option incremental costs have an annualized value of $565 per unit. This does not include ongoing public service costs that increase with sprawl, such as utility maintenance, emergency response and school busing.

Table 6 Twin City Development Patterns Compared (CEE, 1999, p. 23)

	Sprawl (2.1 units/acre)	**Smart Growth (5.5 units/acre)**
Miles of local roads	3,396	1,201
Costs of local roads per unit	$7,420	$2,607
Other infrastructure costs per unit	$10,954	$5,206
Total	$18,374	$7,813

This table shows infrastructure cost savings from “Smart Growth” development that increases residential development from low to medium density.

The city of Lancaster, California development impact fees that reflect the infrastructure costs of a particular location (New Rules, 2002). These fees are calculated by a civil engineering firm based on local development costs. The fees for a typical house located near the city edge are $5,500, but increase to $10,800 if located a mile away, reflecting the additional costs of providing more dispersed infrastructure. Since this price structure was implemented, virtually all new development has been located close to the city.

School travel costs are another example of potential smart growth savings. School busing costs average about $640 per student-year, represent 5-10% of typical school budgets, and even more in rural areas (STN, 2004). Some students must be bused regardless of their home location, due to physical disability or to attend special schools, but for most students, the need to bus and therefore school bus services costs depends on the distance between their home and local schools. Below is the typical distance used by school districts above which students must be provided bus services:

- Grades K - 5: Student lives 1.0 mile or more from school.
- Grades 6 - 8: Student lives 1.5 miles or more from school.
- Grades 9 - 12: Student lives 2.0 miles or more from school.

If half of a community’s land area is devoted to residential development, and there is an average of 0.2 elementary students per household, and an elementary school requires at least 300 students, then residential densities of approximately 1.5 housing units per acre can support an elementary school without requiring busing. As densities decline, an increasing portion of students must be bused.

In addition, busing is sometimes provided for students who live much closer than these distances if a busy roadway creates a barrier to walking and cycling. As a result, as densities decline and vehicle traffic increases, schools must bear increased school busing costs, or households must bear increased financial and time costs chauffeuring children to and from school, and schools and local governments must devote more money to expand road and parking capacity to accommodate these vehicle trips. Note that, except for additional roadway capacity expansion costs, none of these costs are reflected in municipal budgets. Rather, they consist of increased school district expenditures or cuts in other school services, higher household transportation expenditures, and time costs imposed on parents.

The relationships between density and public costs are, of course, complex. Actual costs depend on the specific location and types of services provided. There are also incremental costs associated with increased density, including increased congestion and friction between activities, special costs for infill development, and often higher design standards.

Ewing (1997) concludes that this relationship can be graphed as a tilde (~):

- Costs are low in rural areas where households provide their own services.
- Costs increase in suburban areas where services are provided to dispersed development
- Costs decline with clustering, and as densities increase from low to moderate.
- Costs are lowest for infill redevelopment in areas with adequate infrastructure capacity.

"Because the home and the workplace are entirely separated from each other, often by a long auto trip, suburban living has grown to mean a complete, well-serviced, self-contained residential or bedroom community and a complete, well-serviced place of work such as an office park. In a sense we are building two communities where we used to have one, known as a town or city. Two communities cost more than one; there is not only the duplication of infrastructure but also of services, institutions and retail, not to mention parking and garaging large numbers of cars in both places." (Kelbaugh, 1992).

Many studies consider the incremental costs of building longer water and sewage lines, but not the incremental costs of maintaining and operating them. Similarly, some studies consider the incremental costs of building more roads, but not the costs of maintaining them, or of providing additional parking at destinations due to more automobile-dependent land use patterns.

Conclusions

Smart Growth consists of various development features that create more efficient land use patterns. Numerous studies indicate that Smart Growth can reduce public infrastructure and service costs, providing savings on roads, water, sewage, garbage collection, utilities, school transportation, delivery services, and parking facilities.

Table 8 **Market Distortions That Favor Sprawl** ("Market Principles," VTPI, 2003)
Market Distortion Description

Underpricing Location-Related Costs
Although public service costs tend to be higher for sprawl development, development charges, utility fees and local taxes do not generally reflect these location-related costs.

Excessive Parking and Roadway Requirements
Most zoning codes and development standards require generous road and parking capacity. This encourages lower-density, urban fringe development where land is cheaper, and underprices vehicle travel.

Roadway Right-of-Way

By convention, land use for public roads and parking facilities is exempt from rent and taxes. Economic neutrality implies that land used for roads should be priced and taxed at the same rate for competing uses.

Planning and investments that favor suburbs
Many current planning and public investment practices favor new, lower density, automobile-dependent development over urban infill.

Undervaluing Nonmotorized Modes and Transit
Transportation planning practices tend to undervalue nonmotorized transport modes and transit services, and so underinvest in them.

Residential Lending Practices
Mortgage lenders usually treat car ownership as a financial asset. As a result, lower-income households are encouraged to purchase homes in automobile dependent suburban areas rather than in multi-modal urban locations.

Underpricing Automobile Travel
Automobile travel is underpriced through underpricing of road use, free parking, fixed insurance and registration fees, and various external costs.

"New Urbanism" (http://www.vtpi.org/tdm/tdm24.htm) and "Smart Growth" (http://www.vtpi.org/tdm/tdm38.htm) which discuss new urbanism and smart growth benefits (I consider NU to be smart growth at a local scale, so their benefits overlap).

Todd **Litman** (2003), *Evaluating Criticism of Smart Growth*, VTPI (www.vtpi.org); available at www.vtpi.org/sgcritics.pdf .

Todd **Litman** (2004), *Evaluating Transportation Land Use Impacts*, VTPI (www.vtpi.org); available at www.vtpi.org/landuse.pdf.

Todd **Litman** (2005), *Understanding Smart Growth Savings: What We Know About Public Infrastructure and Service Cost Savings, And How They are Misrepresented By Critics*, VTPI (www.vtpi.org); at http://www.vtpi.org/sg_save.pdf .